

CLAIMS

What is claimed is:

1. A biological flocculant comprising a *Bacillus* bacteria having flocculating effect towards kaolin suspensions or industrial wastewater.
2. The biological flocculant of claim 1, wherein the bacteria is of the species *Bacillus endophyticus*.
3. The biological flocculant of claim 1, wherein the bacteria is of the species *Bacillus cereus*.
4. The biological flocculant of claim 1, wherein the bacteria is of the species *Bacillus subtilis*.
5. The biological flocculant of claim 1, wherein the kaolin suspensions comprises kaolin and $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$.
6. The biological flocculant of claim 5, wherein the kaolin suspensions comprises about 1.25% kaolin and about 3% $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$.
7. The biological flocculant of claim 6, wherein the kaolin suspensions comprises about 20ml of about 1.35% kaolin and about 0.5ml of about 3% $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$.
8. The biological flocculant of claim 1, wherein the bacteria is contained in a bacterial solution comprising nutrient broth that has been incubated under about 30°C, and shaken for at least about 15 hours.
9. The biological flocculant of claim 8, wherein the bacterial solution has been

shaken for at least about 48 hours.

10. A biological flocculant comprising a *Bacillus* bacteria in culture wherein the bacteria has a flocculating effect towards kaolin suspensions or industrial wastewater and wherein the culture further comprises carbon source and nitrogen source.

11. The biological flocculant of claim 10, wherein the carbon source comprises glucose and molasses and the nitrogen source comprises soybean protein.

12. The biological flocculant of claim 11, wherein the glucose is about 10-20 grams/liter, the molasses is about 2-10 grams/liter, and the soybean protein is about 6-30 grams/liter.

13. The biological flocculant of claim 10, wherein the carbon source comprises corn starch and molasses and the nitrogen source comprises soybean protein.

14. The biological flocculant of claim 13, wherein the corn starch is about 10-20 grams/liter, the molasses is about 5-10 grams/liter, and the soybean protein is about 15 grams/liter.

15. The biological flocculant of claim 10, wherein the carbon source comprises glucose and molasses and the nitrogen source comprises soybean protein and yeast.

16. The biological flocculant of claim 10, wherein the bacteria is at least one of *Bascillus endophyticus*, *Bascillus cereus*, or *Bascillus subtilis*.

17. A biological flocculant comprising a fermented solution containing the culture of claim 10.

18. A biological flocculant comprising precipitates collected from the culture of

claim 10.

19. A biological flocculant comprising a *Bacillus* bacteria in culture wherein the bacteria has a flocculating effect towards kaolin suspensions or industrial wastewater and wherein the culture further comprises lactic fermentation wastewater.

20. A flocculant comprising soybean protein with a concentration of at least about 15 grams/liter.

21. The flocculant of claim 20, wherein the soybean protein has a concentration of about 15-120 grams/liter.

22. The flocculant of claim 20, wherein the soybean protein has been subjected to thermal treatments.

23. The flocculant of claim 22, wherein the thermal treatment is 121°C.

24. The flocculant of claim 23, wherein the thermal treatment is at 1.5 atm.

25. The flocculant of claim 24, wherein the thermal treatment is for 20 minutes.

26. A flocculation agent comprising ferric chloride and the flocculant of any of claims 1, 10, 19 or 20.

27. A flocculation agent comprising aluminum chloride and the flocculant of any of claims 1, 10, 19 or 20.

28. A process for making biological flocculant comprising the steps of:

inoculating a *Bacillus* bacteria having flocculating effect towards kaolin suspensions or industrial wastewater onto a culture medium and incubating it for about 60 to 108 hours.

29. The process for making biological flocculant according to claim 28 further comprising the step of subjecting the inoculated culture medium to high temperature

treatment.

30. The process for making biological flocculant according to claim 29, wherein the high temperature treatment is about 60°C-122°C.

31. The process for making biological flocculant according to claim 29, wherein the high temperature treatment is carried out under high pressure.

32. The process for making biological flocculant according to claim 31, wherein the high pressure is about 1.5 atm.

33. The process for making biological flocculant according to claim 28, wherein the culture medium is incubated for about 70 to 80 hours.

34. The process for making biological flocculant according to claim 28, wherein the culture medium is incubated for about 90 to 100 hours.

35. The process for making biological flocculant according to claim 28 further comprising the steps of precipitating out bacterial metabolites and collecting the precipitates.

36. The process for making biological flocculant according to claim 28 further comprising the steps of precipitating out bacterial cells and metabolites and collecting the precipitates.

37. A process for making powdered biological flocculant comprising the steps of:
inoculating a *Bacillus* bacteria having flocculating effect towards kaolin suspensions or industrial wastewater onto a culture medium, incubating it for about 60 to 108 hours, and spray drying the culture medium.

38. The process for making powdered biological flocculant according claim 37, wherein the bacteria is incubated for about 72-96 hours.

39. The process for making powdered biological flocculant according to claim 37, wherein the spray drying is set with an inlet temperature of about 110°C and outlet temperature of about 90°C.

40. The process for making powdered biological flocculant according claim 37, wherein the culture medium comprises carbon source and nitrogen source.

41. The process for making powdered biological flocculant according to claim 40, wherein the carbon source comprises glucose and molasses and the nitrogen source comprises soybean protein.

42. The process for making powdered biological flocculant according to claim 41, wherein the soybean protein is about 15 grams/liter, the glucose is about 10 grams/liter, and the molasses is about 5 grams/liter.

43. The process for making powdered biological flocculant according to claim 40, wherein the carbon source comprises cornstarch and the nitrogen source comprises soybean protein.

44. The process for making powdered biological flocculant according to claim 43, wherein the soybean protein is about 25 grams/liter and the corn starch is about 10 grams/liter.

45. A bacterial culture fermentation process comprising the steps of:
preparing a culture comprising a *Bacillus* bacteria having flocculating effect towards kaolin suspensions or industrial wastewater, glucose, soybean protein, molasses, and yeast, fermenting the culture under temperatures between about 28°C to 30°C for about 40 to 48 hours, setting ventilation volume to about 0.5 – 1.0 VVM, and adjusting initial pH of the culture to about 6-7.

46. A method for treating water comprising the step of introducing the flocculant of claims 10 or 15.

47. The method for treating water according to claim 44, wherein 2 ml/liter of the flocculant of claims 10 or 15 is added.

48. A powdered biological flocculant comprising a spray dried culture medium of a *Bacillus* bacteria.

49. The powdered biological flocculant of claim 48, wherein the bacteria is at least one of *Bascillus endophyticus*, *Bascillus cereus*, or *Bascillus subtilis*.

50. A method for treating water comprising the steps of:
mixing powders of powdered biological flocculant of claim 48 with tap water into 1% powder solution, adjusting pH of about 500 ml of water to be treated, and introducing about 1 ml of 1% powder solution into the about 500 ml water.

51. The method for treating water according to claim 50, wherein the pH ranges from about 6.3 to 6.5.

52. The method for treating water according to claim 51, wherein the pH is adjusted by adding poly aluminum chloride.

53. The method of treating water according to claim 50, wherein the water is wastewater from the food industry.

54. A method of treating water comprising the step of introducing into water the soybean protein flocculant of claim 20.

55. The method of treating water according to claim 54, wherein the soybean protein has a concentration of about 15 to 120 grams/liter.

56. The method according to claim 55, wherein the soybean is introduced in a

dosage of about 0.2 ml/liter to 0.5 ml/liter.

57. A process for activating preserved bacterial strain comprising the steps of:

streaking the preserved *Bacillus* bacteria having flocculating effect towards kaolin suspensions or industrial wastewater onto tryptic soy agar of a concentration of about 40 grams/liter and incubating the culture for about 1-2 days under about 30°C.